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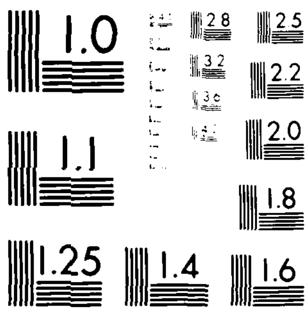

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FOREIGN TECHNOLOGY DIVISION

NEW TYPE OF UNIQUE FREQUENCY LASER COMMUNICATIONS

by

Zhen-Rui Sun

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NEW TYPE OF UNIQUE FREQUENCY LASER COMMUNICATIONS

Zhen-Rui Sun

Optical fiber communications have been developed rapidly in some laboratories up until now. For example, the single-mode optical fiber has been invented to transmit light beams with a unique frequency. The present existing multimode optical fiber which is used to transmit light beams with several frequencies may be replaced by such a single-mode optical fiber. In order to make this optical fiber useful, Bell Telephone Laboratories has developed a controllable solid state laser which can produce super pure unique frequency light beams.

At present the optical fiber technique, using multimode optical fiber, a non-unique frequency laser and light emitting diodes, can transmit signals over a long distance (much longer than by transmitting electrical waves in copper wire) with very low rate of error. However, the ordinary laser can only emit light signals within a certain frequency range. Therefore, if the single-mode optical fiber can be used conjunctly with the unique frequency laser, the transmission system will be able to transmit signals over a longer distance with ultra-high capacity and practically with no error at all.

The unique frequency laser, which is also called cleaved-coupled-cavity (or C^3 in short) can produce super pure light beams with a unique frequency. Its size is only half of the date character on an American coin. This new research result is an application of the coupled-cavity theory, which has been a Bell Laboratories patent since 1965.

C^3 was discovered by W. T. Tsang at Bell Laboratories and consists of a semiconductor laser. At first it is divided into two parts very accurately. The signal frequency can be changed by changing the current through these two halves of the semiconductor laser. When the current through the laser is changed, the light beams will "spread out". By getting rid of the colored light and by using the principle that the diffraction angle varies with different frequencies to sift out light beams of unique frequency, super pure unique frequency light beams are obtained. According to the present experimental record, the light signal emitted by such super pure laser beams can travel as far as 119 kilometers.

C^3 laser has been tested at 10 different frequencies with a conversion rate of a billion times per second. It can code several signals in one light beam. This is the so-called frequency conversion control technique. Several laser beams emitted with different frequencies can be carriers for different signals transmitted in a single optical fiber. This technique is called the wavelength distributive multimode transmission technique. Frequency conversion control technique and wavelength distributive multimode transmission technique can increase significantly the number of signals transmitted in one optical fiber.

The final goal of the optical fiber technique is to transmit as many signals as possible, fast and without error. The light pulses in a multimode optical fiber tend to cover each other. This shortcoming may be greatly reduced by using a unique frequency in the single-mode optical fiber. As indicated by Arno Penzias, the deputy director of the Research Division of Bell Laboratories, at a transmission rate of 420 million bits per second, a thirty volume encyclopedia can be completely transmitted within one second with a one bit error rate, which corresponds to less than a single letter error within a thirty volume book.

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